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RONE ENGINEERS PROJECT NO. 4-0693-07

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RESISTIVITY SURVEY
GARLAND SANITARY LANDFILL
GARLAND, TEXAS

Presented To:

CITY OF GARLAND

OCTOBER, 1987

Rone Engineers
Geotechnical Consultants
Materials Testing

11234 Goodnight Lane
Dallas, Texas 75229
(214) 241-4517 Metro 263-1555

RoneEngineers

October 30, 1987
Report No. 4-0693-07

City of Garland
P. O. Box 469002
1434 E. Garland Road
Garland, Texas 75046-9002
ATTN: Mr. Kenneth C. Smith
Director of Sanitation

**RESISTIVITY SURVEY
GARLAND SANITARY LANDFILL
GARLAND, TEXAS**

Dear Mr. Smith:

Submitted here are the results of the resistivity survey for the referenced project. These studies were authorized on September 10, 1987.

The purpose of the resistivity survey has been to provide additional interpretative information of the subsurface conditions.

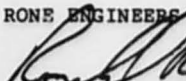
Field procedures were performed in accordance with Texas Department of Health, Division of Solid Waste, Management, "Guidelines for Conduction and Reporting Earth Electrical Resistivity Surveys" Technical Guide update, May, 1985.

Methods of data collection, interpretation and analysis are included in the report section. Resistivity soundings and profiles at each location are included in the **Appendix**.

We trust this is the information you desire. If any questions arise, please do not hesitate to call.

Very truly yours,

RON E ENGINEERS


Ronald F. Reed,
Vice-President, E



HTK/RFR/aap

copies submitted: 4 City of Garland/Mr. Kenneth C. Smith

To Be Safe Use Rone Engineers

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PURPOSES AND SCOPE OF STUDY

The purpose of the resistivity survey has been to provide additional interpretative information of the subsurface conditions.

The resistivity data collected around Sector G will be used as a background resistivity survey for this future fill site. All other resistivity data is to serve as a background survey around existing fill locations. The purpose of these surveys is to aid in the identifying and locating of possible existence of leachate migration.

FIELD INVESTIGATIONS

Resistivity data was obtained in the field utilizing a Bison Model 2350 Earth Resistivity Meter. Electrode arrangement used the Wenner Array of four probes at equal spacing centered along the specific survey point. Two separate resistivity evaluations were made: sounding and profiling.

Resistivity profiling was performed at approximately 100- and 200-foot stations along boundary lines of Sectors A, C, F, and G of the landfill. These locations are shown on Plate 1 of the Appendix. Profiling measures the apparent resistivity change, laterally. The electrode spacing is kept constant and the electrode configuration

moved from station to station. The electrode spacing used in most cases was 35 feet. A summary of graphs of resistivity profiling data at 58 surveyed stations are presented on Plates 2 and 3. Resistivity Profiling Data Sheets, Plates 4 through 12, present data for the stations along with comments regarding data acquisitions or surface features which could affect interpretation.

Several profiling points were not evaluated. The presence of surface features (i.e., spring, pond and roads) made it impossible to set up the resistivity meter and acquire a representative value of apparent resistivity. Specific features prohibiting readings are described in the **Remarks** column of the data sheets. Any profiling locations in the area where filling had been completed were also eliminated. This can be noted on Plate 1 of the **Appendix**.

Resistivity soundings were performed at 12 locations shown on Plate 1 in Sector G. Sector G is to serve as the future dump site, therefore, these soundings will serve as baseline values for future surveys. At each sounding station, an initial electrode spacing of three feet was used. This spacing was increased in three foot increments to a final spacing of 36 feet.

Sounding measures the apparent resistivity change with depth. The electrode spacing is increased from a center point at a set interval. As the electrode spacing is increased the depth of penetration increases. The apparent resistivity of each successive interval is determined in three foot increments to a final spacing of 36 feet.

Plates 13 through 24 present resistivity sounding graphs summarizing data calculations. Detailed readings and comments are provided on Plates 25 through 36.

Field procedures were performed in general accordance with Texas Department of Health, Division of Solid Waste, Management, "Guidelines for Conducting and Reporting Earth Electrical Resistivity Surveys" Technical Guide updated, May 1985.

INTERPRETATION

Three methods were used to analyze the electrical resistivity data obtained from the soundings, the Barnes' Layer Method, Moore's Cumulative Method, and a direct plot of apparent resistivity. Plots of each of these methods are included in the Appendix, Plates 13 through 24.

The Barnes' Layer Method assumes the soil is in layers with a thickness equal to the spacing of the electrodes (three feet in this case) and each layer has a specific apparent resistivity. The specific value of apparent resistivity is assumed to be an average of all the actual values for each soil type or strata in the assumed layer. This method is useful in determining the soil types per three-foot layer.

The Moore's Cumulative method is a plot of the meter values multiplied by the electrode spacing versus increasing depth. A straight line is then drawn through as many points as possible. The change in slope of the line then indicates a change in the trend of the resistivity with depth.

The last method (the direct plot), is useful in aiding the interpretation of Moore's Cumulative Method. It is a direct plot of the apparent resistivity at the specific depth read. This depth is assumed to be equal to the electrode spacing. It is useful in that it depicts small changes in resistivity at varying depths, which might be masked in the Cumulative Method.

To summarize the three methods the following is offered. Major changes in lithology or other changes which affect resistivity (i.e., groundwater) can be analyzed using the Moore's Cumulative Method. The plot of resistivity versus depth (direct method) allows the data to be analyzed at the micro level to aid in interpretation. The Barnes' Layer Method provides an analysis of the data at intervals

(three feet) from which soil types can be interpreted. Some of the characteristics of each method are summarized below.

Purpose

Barnes' Method shows actual soil types.

Moore's Method shows major changes in geologic strata.

Direct Plot shows minor breaks.

Direct Plot shows trends, and change in gradation.

Consideration

Barnes' Method accuracy is affected by the spacing between the electrodes.

Barnes' Method assumes that the soil is uniform within the spacing.

Moore's Method is a plot of cumulative data and does not show detail.

With Moore's Method it is difficult to interpret soil types.

Direct Plot is useful principally to aid in the interpretation of the Moore's Method.

All methods show apparent resistivity.

RESULTS

The subsurface investigation was conducted using 12 sounding locations and several profile lines. The data collected are shown on Plates 4 through 12 for the profiles and Plates 25 through 36 for the sounding data. The data were plotted for analyses for each profile on Plates 2 and 3 and for each sounding on Plates 13 through 24.

All three methods described previously were used for the interpretation.

In addition to the resistivity data, boring logs and a geological investigation were also use to aid in the interpretation of the existing subsurface conditions.

Each of the soundings show a low apparent resistivity with few exceptions. Two soundings, S-7 and S-8, indicate large changes in the apparent resistivity on the Barnes' Layer Method. The Moore's Method, however, does not indicate these large changes in the apparent resistivity. It is most probable that surface features (i.e., trash, soil conditions), were the cause of the larger change.

The profiling data reinforces what was evident from the soundings. The profiles, which were run at a depth of 35 feet also indicate that there is almost entirely clay and shale at that depth.

There are two points on sounding plots S-10 and S-11, where there is an assumed value for the Barnes' Method because the data point collected is greater than the previous point. When this occurs, a negative value is produced, although it is impossible to have this situation. The Moore's Method indicates, however, a somewhat consistent data point.

Continual observation of existing monitor wells around the site will aid in correlating the possible existence of leachate in the vicinity of questionable data points.

Groundwater

The soundings do not indicate any characteristics that can be interpreted as groundwater. If saturated soil or perched groundwater is present in the survey area, it is masked by the surrounding clays. This indicates any water present is limited in extent, both vertically and horizontally.

Factors Affecting Comparison

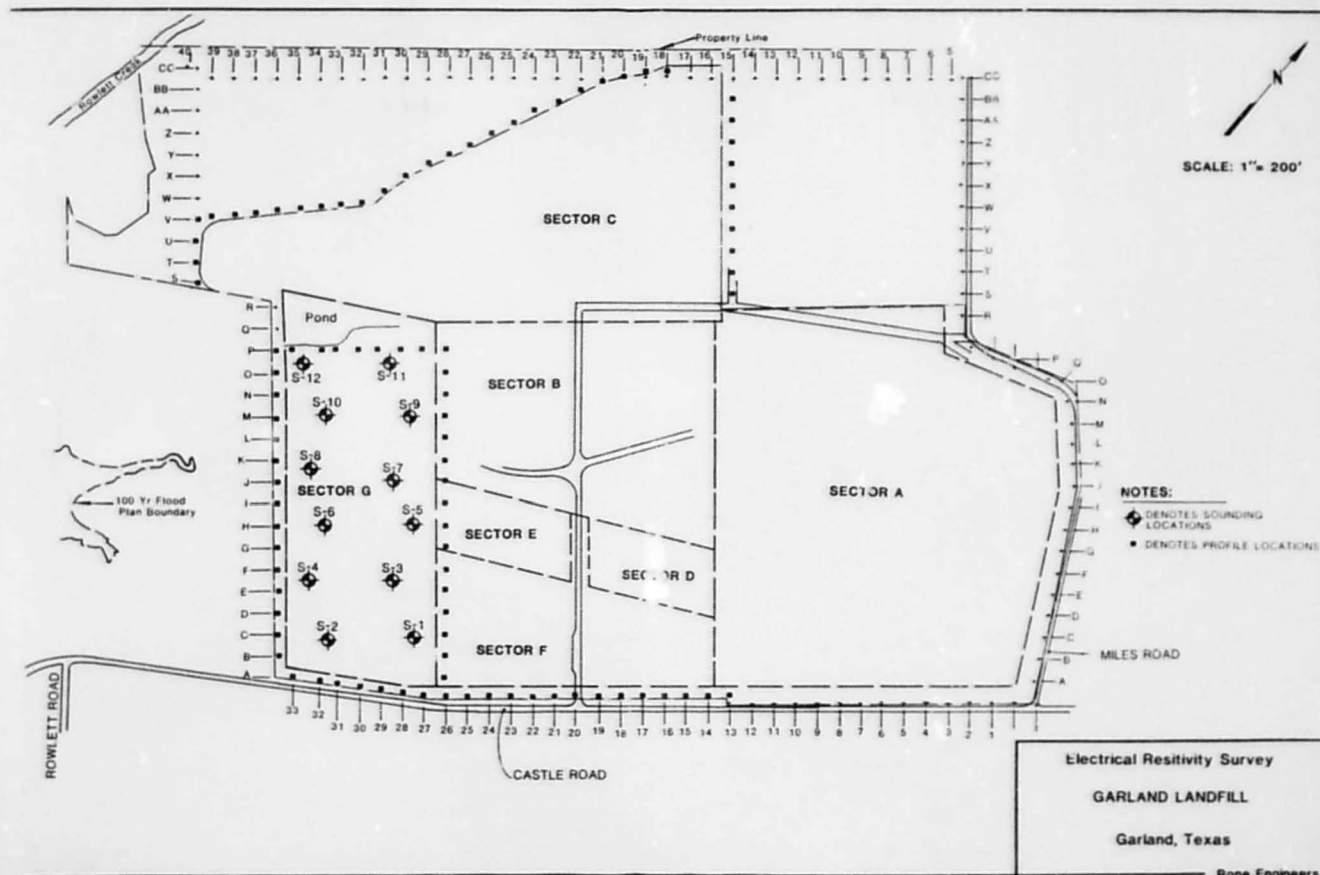
Topographic features such as road cuts and fill piles affect the current flow lines and density between electrodes.

One minor problem area concerns the spacing of profiling locations. Without permanent reference points or stakes to show precise location, minor discrepancies in location can occur.

The current study was conducted in September, 1987 during periods of rainfall. This may account for some differences in values which may be collected during dry weather in the future.

CONCLUSIONS

1. The data confirms the soil types which appeared in the geotechnical report.
2. An adequate baseline was established to evaluate the potential for leachate migration by future surveys.
3. Any groundwater present is limited in extent.

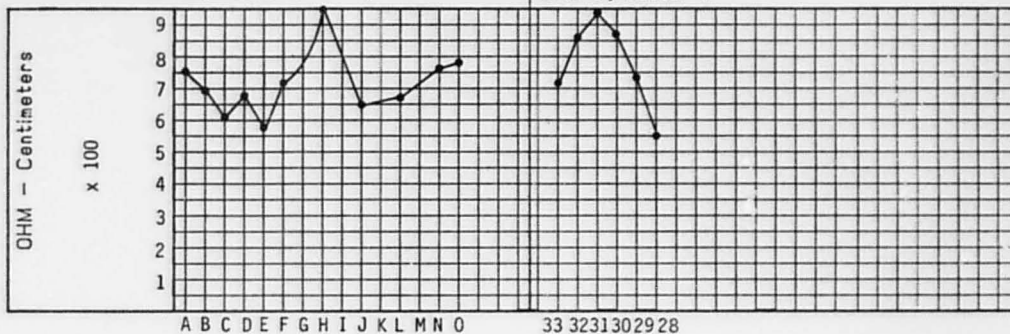


DATE: September 1987

GRAPHS FOR RESISTIVITY PROFILE READINGS

PROFILE Line 33, Sector G

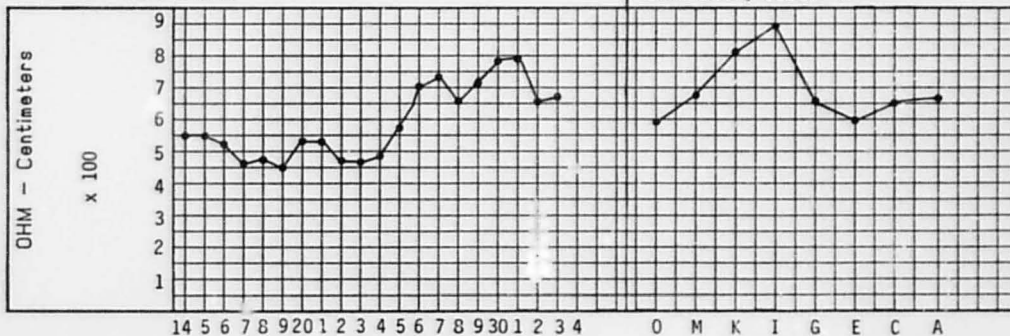
Line P, Sector G



Backwards

PROFILE Castle Road

Line 26.5, Sector G

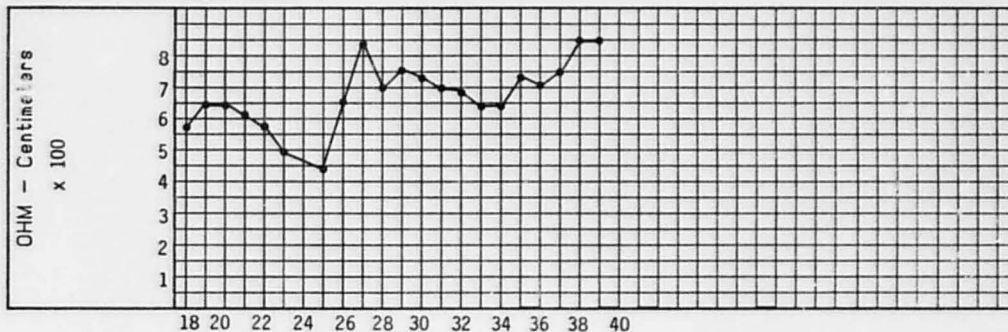


GARLAND LANDFILL

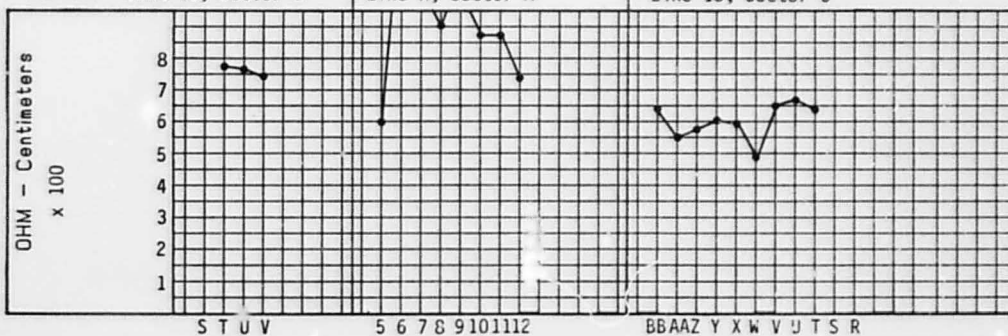
DATE: September 1987

GRAPHS FOR RESISTIVITY PROFILE READINGS

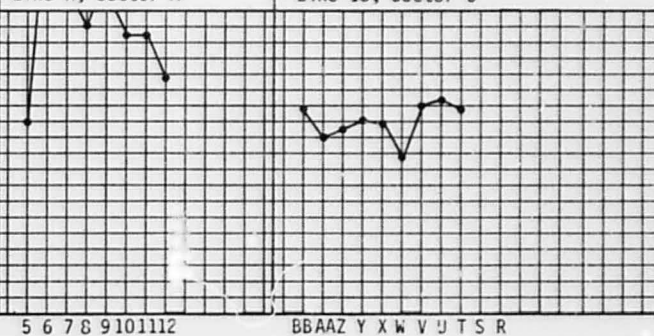
PROFILE West Edge, Sector C



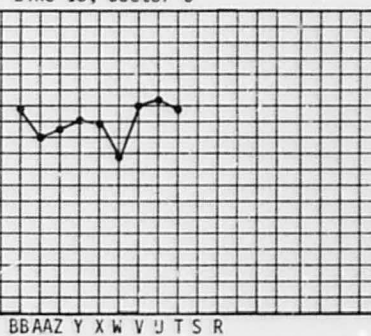
PROFILE Line 40, Sector C



Line R, Sector A



Line 15, Sector C



6 - 986 9 - 1295
7 - 1900

RESISTIVITY DATA SHEET FOR PROFILING SURVEY

PROJECT Garland Landfill

UNIT

PROFILE NO. Line 33, Sector G

SOIL CONDITION Dry

ARRAY

DATE September 21, 1987

Distances Between Stations/Electrodes 100' and 200' (see below)

STATION	Electrode Placement Feet		Electrode Spacing Feet	READINGS (R)				SCALE (S)	Dial Value Ohms D = R x S	D x A x 30.5 Ohm - Cm	REMARKS
	V	I		SP	I	V	2TV/I				
A	17.5	52.5	35'				707.5	.001	0.708	755.8	8' perpendicular to Castle Road fence line, 10' away from So. fence line
B	17.5	52.5	35'				653.4	.001	0.653	697.1	
C	17.5	52.5	35'				574.5	.001	0.574	612.7	
D	17.5	52.5	35'				625.8	.001	0.626	668.3	
E	17.5	52.5	35'				547.2	.001	0.547	583.9	
F	17.5	52.5	35'				681.5	.001	0.682	728.0	
G											
H	17.5	52.5	35'				899.6	.001	0.900	960.8	High Reading?
I							---	---			
J	17.5	52.5	35'				610.5		0.611	652.2	Bottom of Stream Bed
K							---	---			
L	17.5	52.5	35'				631.7	.001	0.632	674.7	
M							---	---			
N	17.5	52.5	35'				713.5	.001	0.714	762.2	
O	17.5	52.5	35'				731.8	.001	0.732	781.4	Ground Moist Due to Pond
P							---	---			
Q							---	---			
R							---	---			

RESISTIVITY DATA SHEET FOR PROFILING SURVEY

PROJECT Garland Landfill

UNIT

PROFILE NO. Castle Road

SOIL CONDITION Dry

ARRAY

DATE September 17, 1987

Distances Between Stations/Electrodes 100'

STATION	Electrode Placement Feet		Electrode Spacing Feet	READINGS (R)				SCALE (S)	Dial Value Ohms D = R x S (D)	D x A x 30.5 Ohm - Cm	REMARKS
	V	I		SP	I	V	2πVI				
14	17.5	52.5	35'				515.1	.001	0.515	549.8	
15	17.5	52.5	35'				515.9	.001	0.516	550.8	
16	17.5	52.5	35'				490.1	.001	0.490	523.1	
17	17.5	52.5	35'				437.2	.001	0.437	466.5	
18	17.5	52.5	35'				443.2	.001	0.443	472.9	
19	11.5	34.5	23'				643.0	.001	0.643	451.1	At East Entrance Fence
20	12	36.0	24'				732.4	.001	0.732	535.8	At West Entrance Fence
21	17.5	52.5	35'				501.8	.001	0.502	535.9	
22	17.5	52.5	35'				445.5	.001	0.446	476.1	
23	17.5	52.5	35'				435.3	.001	0.435	464.4	
24	17.5	52.5	35'				458.0	.001	0.458	488.9	
25	17.5	52.5	35'				539.1	.001	0.539	575.4	
26	17.5	52.5	35'				661.6	.001	0.662	706.7	
27	17.5	52.5	35'				692.1	.001	0.692	738.7	
28	17.5	52.5	35'				619.9	.001	0.620	661.9	
29	17.5	52.5	35'				671.2	.001	0.671	716.3	
30	17.5	52.5	35'				732.0	.001	0.732	781.4	
31	17.5	52.5	35'				744.3	.001	0.744	794.2	
32	17.5	52.5	35'				614.9	.001	0.615	656.5	
33	17.5	52.5	35'				630.7	.001	0.631	673.6	

PLATE 6

RESISTIVITY DATA SHEET FOR PROFILING SURVEY

PROJECT Garland Landfill

UNIT

PROFILE NO. Line 26.5, Sector

SOIL CONDITION Dry

ARRAY

DATE September 21, 1987

Distances Between Stations/Electrodes 200'

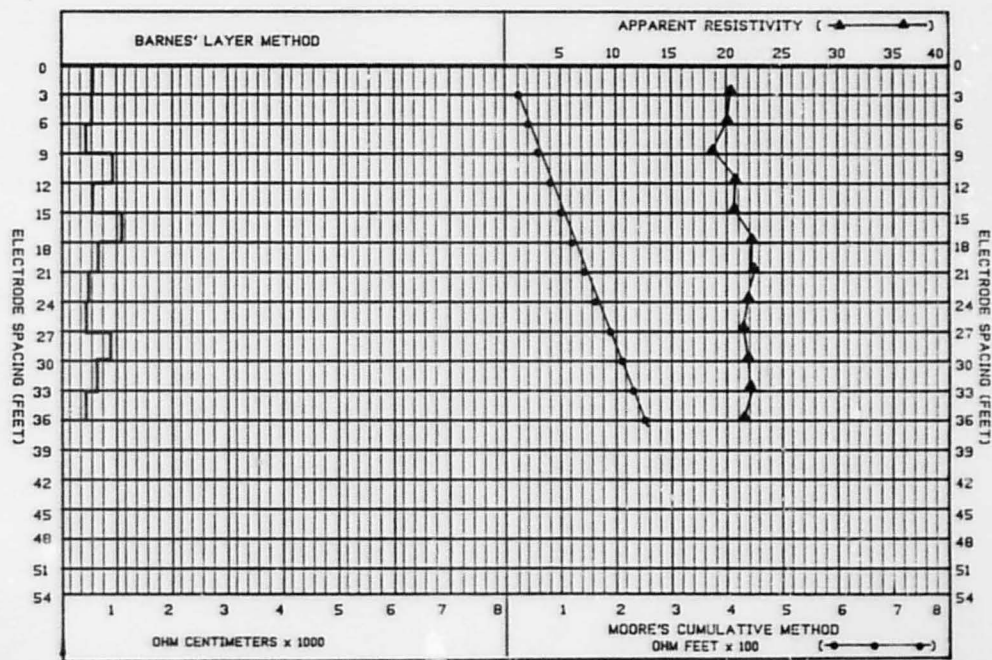
S T A T I O N	Electrode Placement Feet		Electrode Spacing Feet (A)	READINGS (R)				S C A L E (S)	Dial Value Ohms D = R x S (D)	D x A x 30.5 Ohm - Cm	REMARKS
	V	I		SP	I	V	2πV/I				
O	17.5	52.5	35'				553.5	.001	0.554	591.4	
N							---				
M	17.5	52.5	35'				633.3	.001	0.633	675.7	
L							---				
K	17.5	52.5	35'				760.5	.001	0.760	811.3	
J							---				
I	17.5	52.5	35'				841.0	.001	0.841	897.8	
H							---				
G	17.5	52.5	35'				618.4	.001	0.618	659.7	
F							---				
E	17.5	52.5	35'				559.1	.001	0.559	596.7	
D							---				
C	17.5	52.5	35'				607.5	.001	.608	649.0	
B							---				
A	17.5	52.5	35'				623.1	.001	0.623	665.1	

PLATE 7

Distances Between Stations/Electrodes 100' - 120' (see below)PLATE 8

Distances Between Stations/Electrodes 100' - 120' (see below)PLATE 9

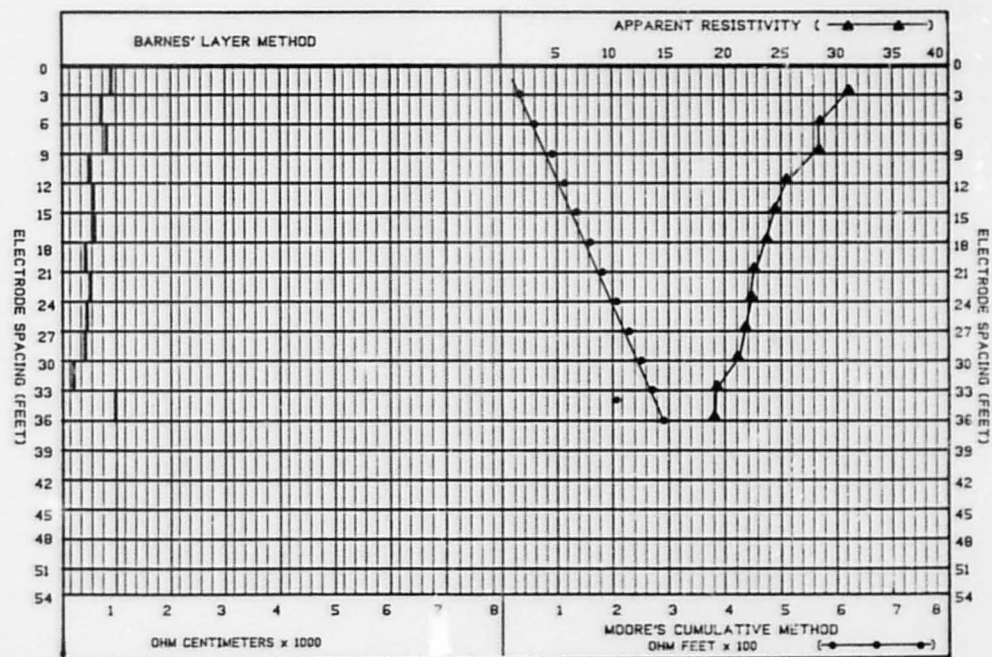
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-1

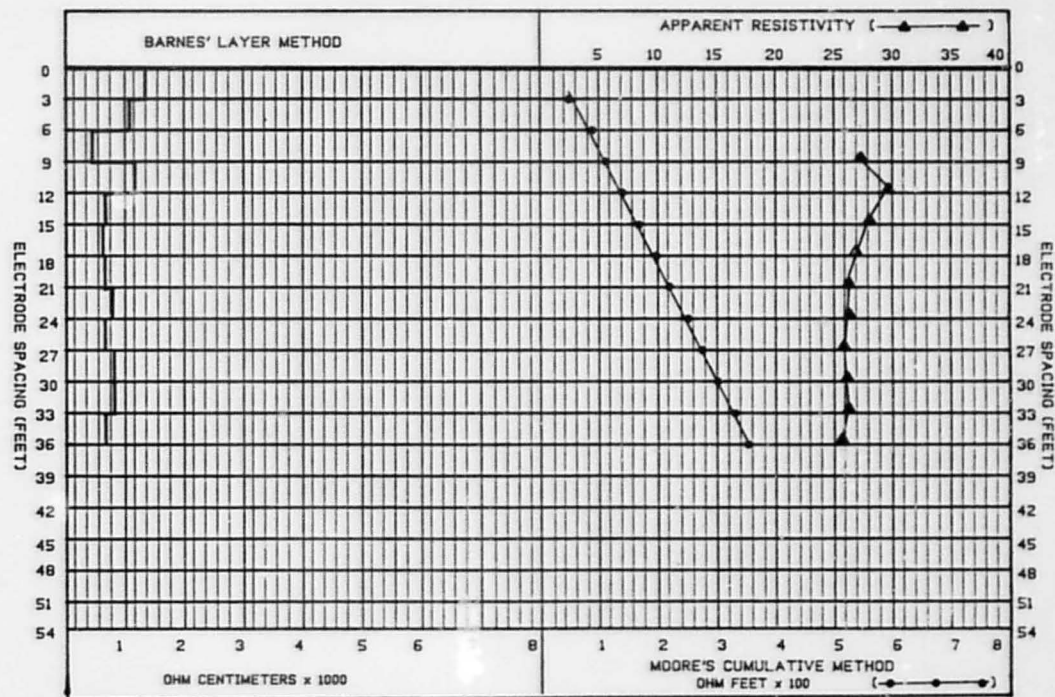
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-2

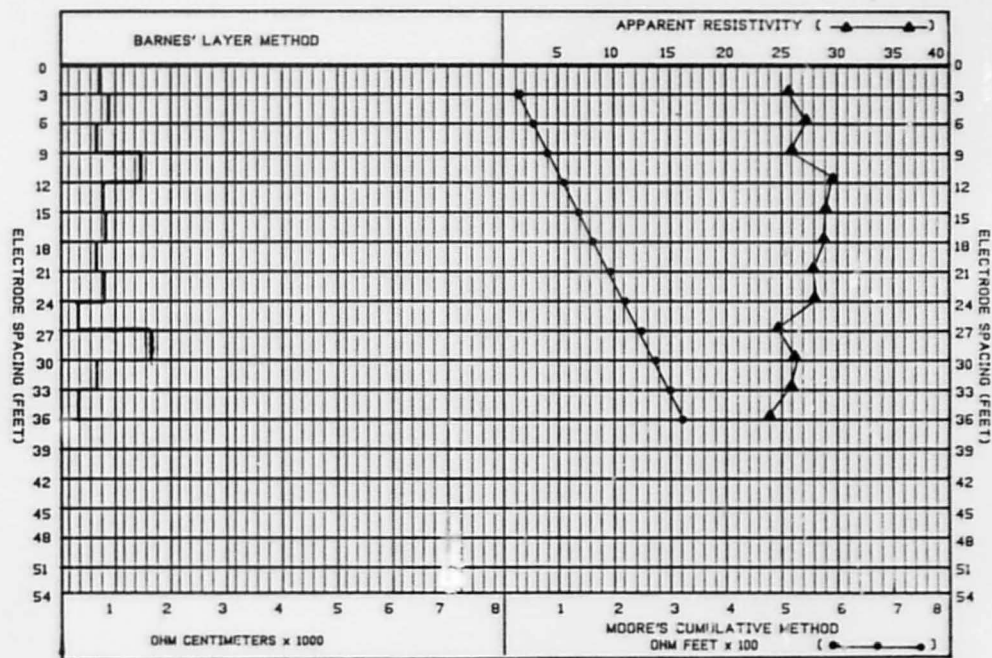
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-3

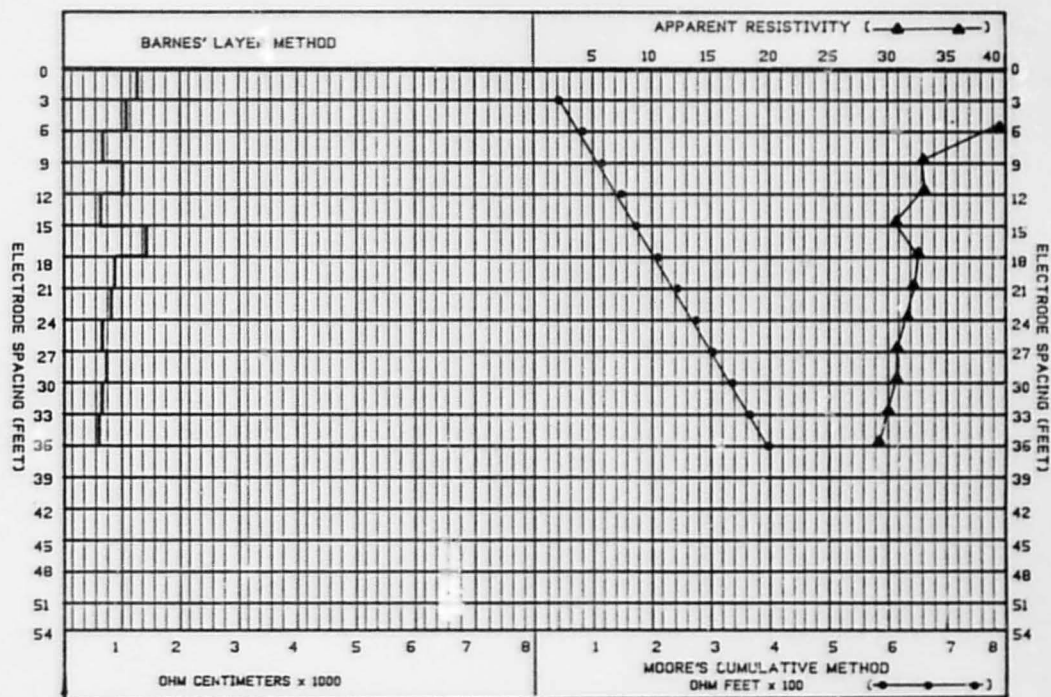
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-4

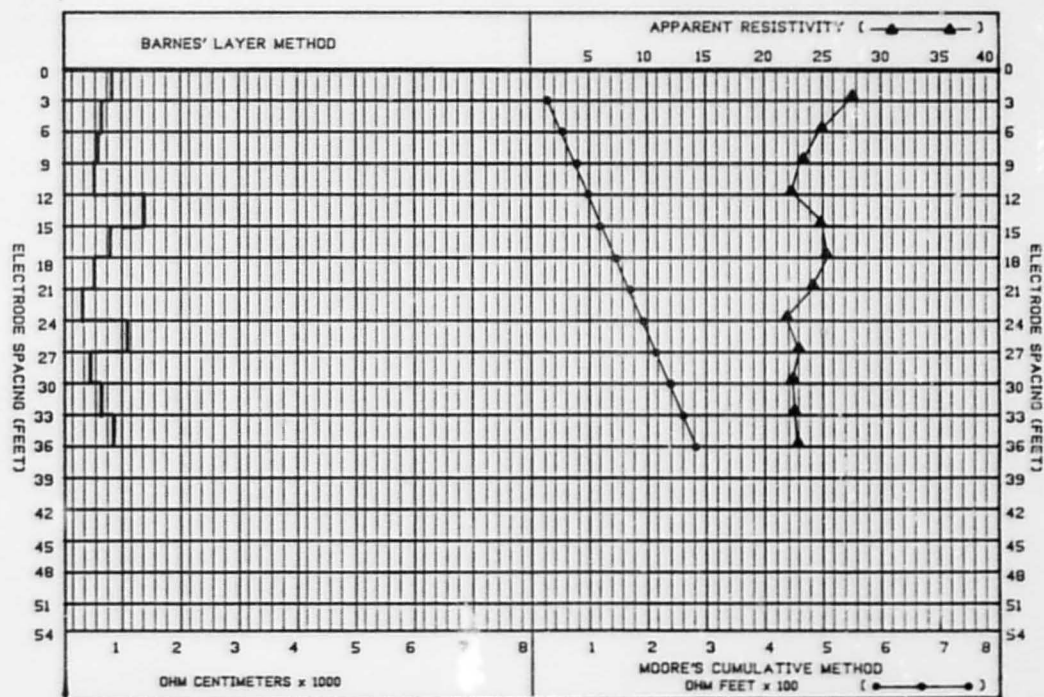
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-5

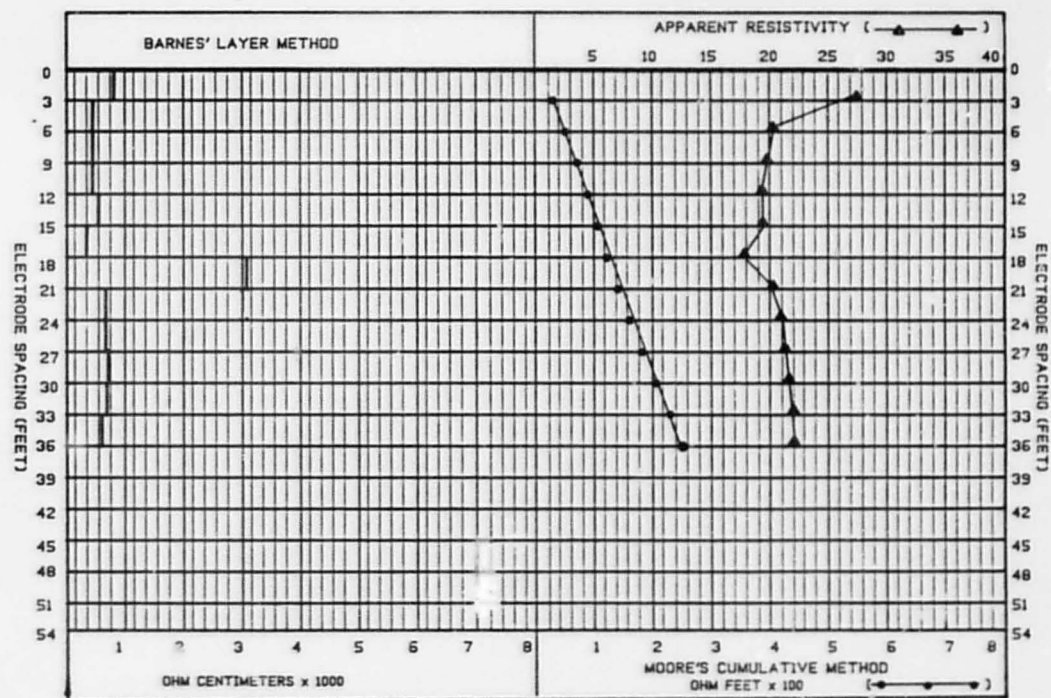
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-6

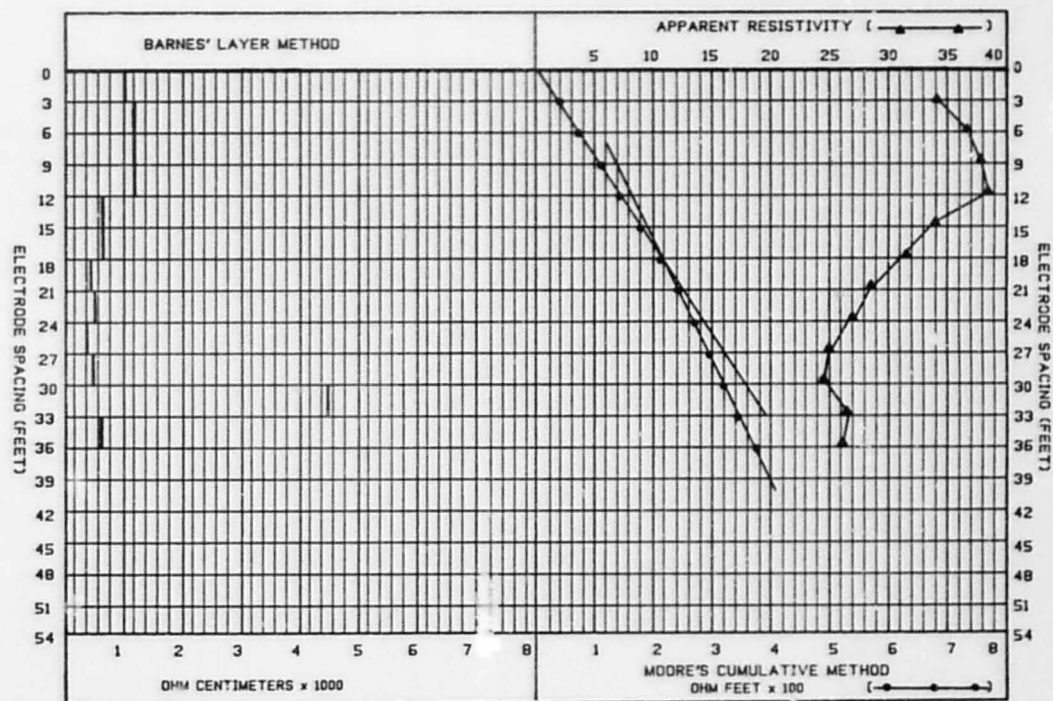
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-7

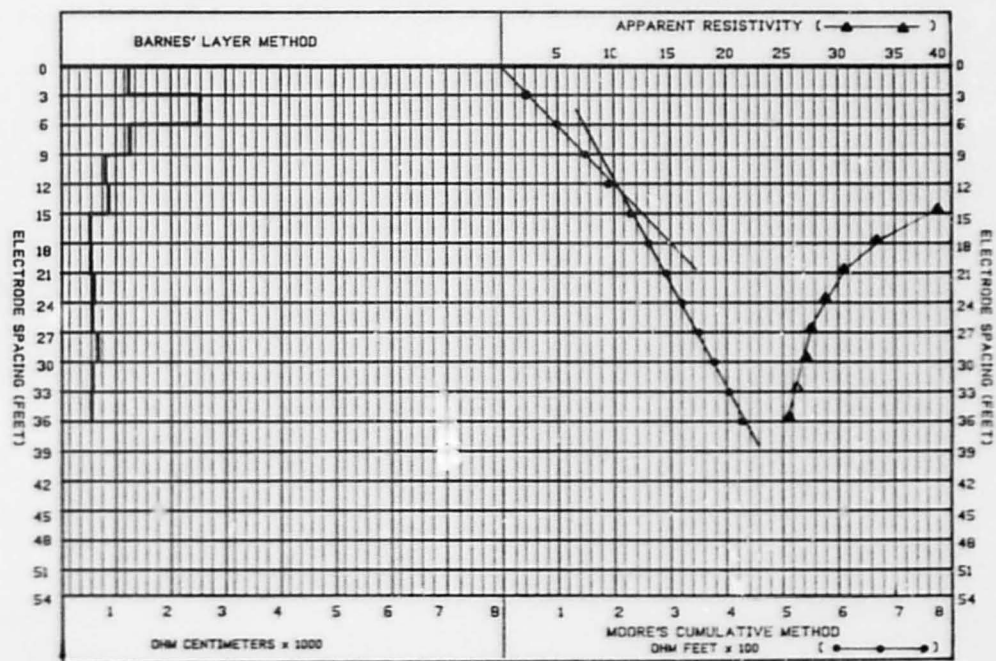
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-8

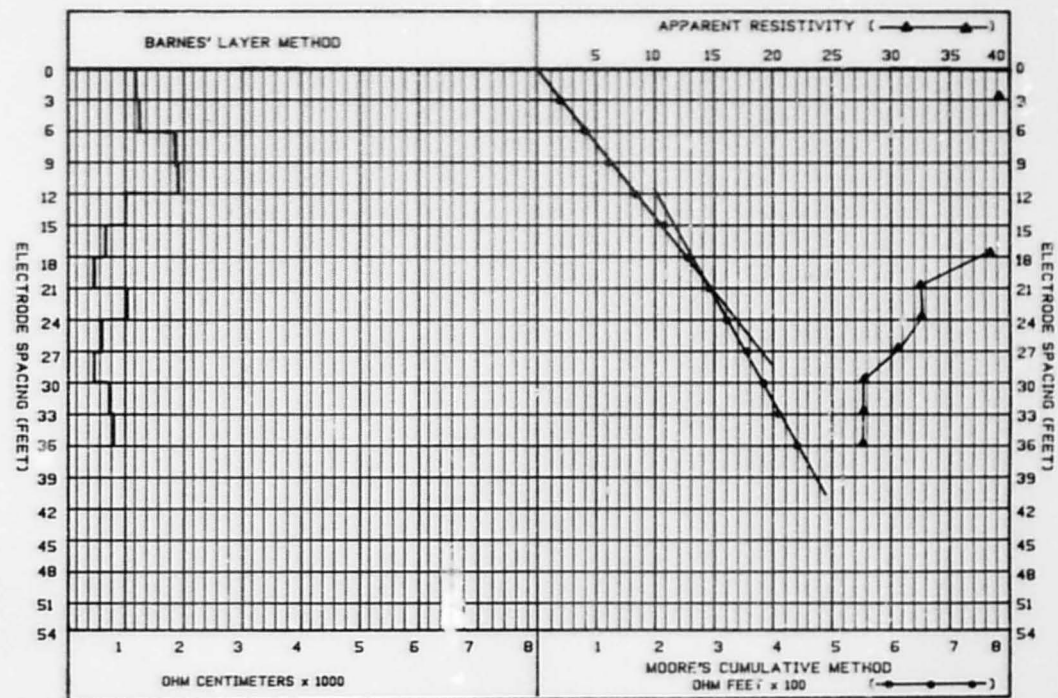
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-9

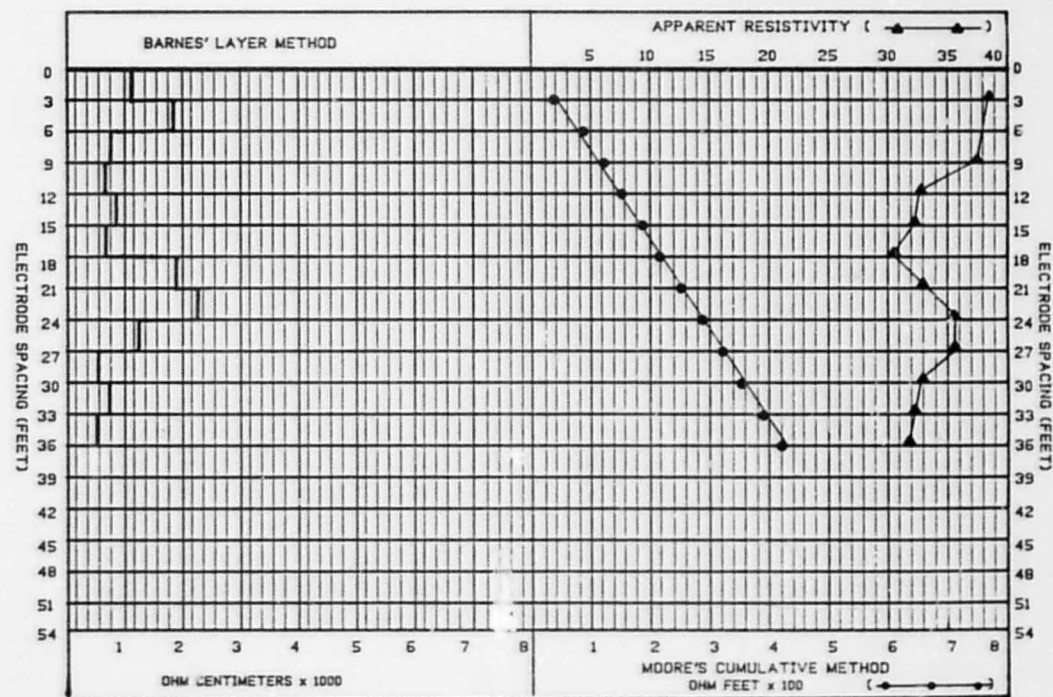
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-10

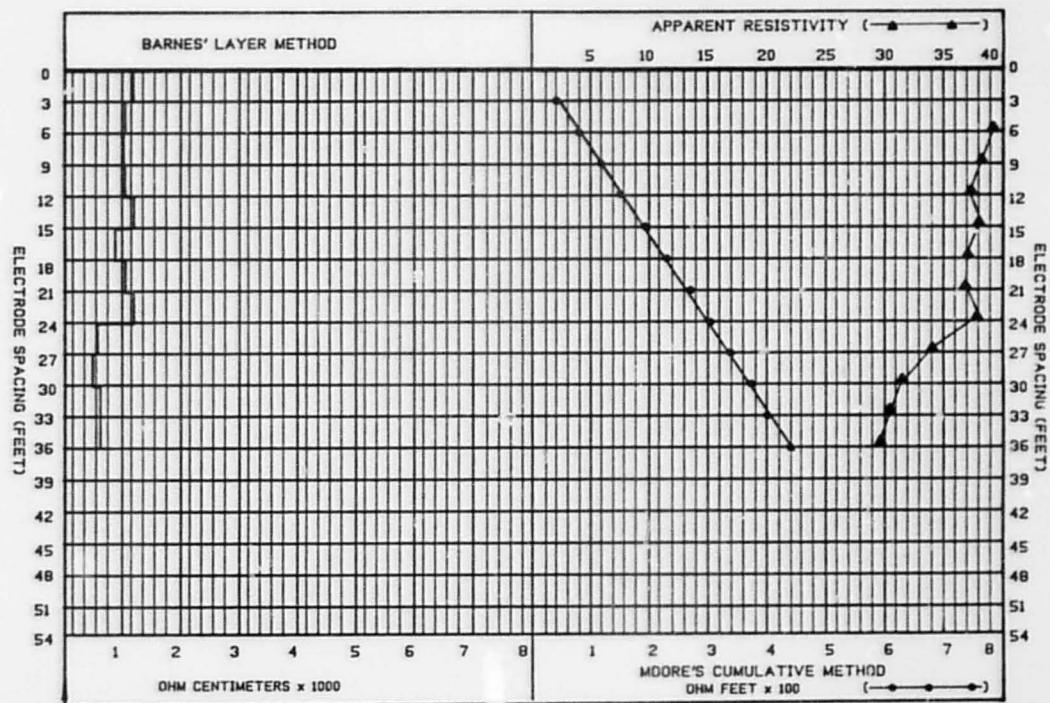
Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-11

Graph for RESISTIVITY SOUNDING



PROJECT: GARLAND LANDFILL

SOUNDING: S-12

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-1, Sector G

SOIL CONDITION Dry

ARRAY _____

DATE September 28, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A - A_1) D_1 \cdot D_2 \times 30.5$ $D_1 - D_2$ ohm - cm. (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	675.0	.01				6.750	617.6	20.3	20.3	
3-9	6	335.1	.01				3.351	608.9	20.1	40.4	
4.5-13.5	9	206.5	.01				2.065	492.4	18.6	58.9	
6-18	12	172.8	.01				1.728	968.8	20.7	97.7	
7.5-22.5	15	137.5	.01				1.375	615.9	20.6	100.3	
9-27	18	123.1	.01				1.231	1075.5	22.2	122.5	
10.5-31.5	21	106.6	.01				1.066	727.7	22.4	144.8	
12-36	24	911.4	.001				0.911	575.3	21.9	166.7	
13.5-40.5	27	789.0	.001				0.789	539.1	21.3	188.0	
15-45	30	731.8	.001				0.731	909.9	21.9	209.9	
16.5-49.5	33	665.7	.001				0.666	685.3	22.0	231.9	
18-54	36	595.3	.001				0.595	510.7	21.4	253.3	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-2, Sector G

SOIL CONDITION Dry

ARRAY _____

DATE September 28, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2 TTV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $\frac{(A - A') D}{D - D'} \times 30.5$ ohm - Cm (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	104.1	.1				10.41	952.5	31.2	31.2	
3-9	6	475.1	.01				4.751	799.7	28.5	59.7	
4.5-13.5	9	315.8	.01				3.158	361.8	28.4	88.2	
6-18	12	212.2	.01				2.122	591.9	25.5	113.6	
7.5-22.5	15	162.6	.01				1.626	636.5	24.4	138.0	
9-27	18	132.9	.01				1.329	665.7	23.9	161.9	
10.5-31.5	21	107.8	.01				1.078	522.3	22.6	184.6	
12-36	24	924.5	.001				0.924	591.8	22.2	206.7	
13.5-40.5	27	803.4	.001				0.803	561.1	21.7	228.4	
15-45	30	699.3	.001				0.699	493.8	21.0	249.4	
16.5-49.5	33	579.5	.001				0.580	311.7	19.1	268.5	
18-54	36	550.5	.001				0.551	1008.3	19.8	288.4	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-3, Sector G

SOIL CONDITION Dry

ARRAY _____

DATE September 28, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TTV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A - A) \frac{D}{D} \times 20.5$ ohm - cm (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	153.0	.1				15.30	1400.0	45.9	45.9	
3-9	6	667.8	.01				6.678	1084.3	40.1	86.0	
4.5-13.5	9	303.9	.01				3.039	510.3	27.4	113.3	
6-18	12	247.7	.01				2.477	1225.6	29.6	143.0	
7.5-22.5	15	187.4	.01				1.874	704.4	28.1	171.1	
9-27	18	149.6	.01				1.496	678.4	26.9	198.0	
10.5-31.5	21	125.3	.01				1.253	705.8	26.3	224.3	
12-36	24	109.9	.01				1.099	818.2	26.4	250.7	
13.5-40.5	27	961.2	.001				0.961	700.3	25.9	276.7	
15-45	30	869.4	.001				0.869	830.6	26.1	302.7	
16.5-49.5	33	793.4	.001				0.793	829.7	26.2	328.9	
18-54	36	720.3	.001				0.720	715.7	25.9	354.8	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-4, Sector G

SOIL CONDITION Dry

ARRAY _____

DATE September 28, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A_s - A) D_s \times 30.5$ $D_s - D_s$ ohm - cm (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	857.7	.01				8.577	784.8	25.7	25.7	
3-9	6	454.3	.01				4.543	883.8	27.3	53.0	
4.5-13.5	9	288.7	.01				2.887	724.7	26.0	79.0	
6-18	12	246.5	.01				2.465	1543.0	29.6	108.6	
7.5-22.5	15	193.1	.01				1.931	815.6	29.0	137.5	
9-27	18	160.2	.01				1.602	860.3	28.8	166.4	
10.5-31.5	21	133.0	.01				1.330	716.7	27.9	194.3	
12-36	24	116.5	.01				1.165	859.2	28.0	222.2	
13.5-40.5	27	91.6	.01				0.916	392.1	24.7	247.0	
15-45	30	873.1	.001				0.873	1701.6	26.2	273.2	
16.5-49.5	33	786.1	.001				0.786	721.7	25.9	299.1	
18-54	36	667.5	.001				0.668	407.1	24.0	323.2	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-5, Sector G

SOIL CONDITION _____

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TRV/I (R)	SCALE (I)	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $\frac{(A) \times (D)}{D_1 - D_2} \times 30.5$ (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	141.7	1				14.17	1296.6	42.5	42.5	
3-9	6	659.1	.01				6.591	1127.5	39.5	82.1	
4.5-13.5	9	369.1	.01				3.691	767.6	33.2	115.3	
6-18	12	276.5	.01				2.765	1008.4	33.2	148.5	
7.5-22.5	15	205.2	.01				2.052	728.1	30.8	178.2	
9-27	18	181.7	.01				1.817	1451.7	32.7	211.9	
10.5-31.5	21	153.8	.01				1.538	916.5	32.3	244.2	
12-36	24	132.3	.01				1.323	866.0	31.8	276.0	
13.5-40.5	27	114.2	.01				1.142	763.8	30.8	306.8	
15-45	30	102.3	.01				1.023	898.3	30.7	337.5	
16.5-49.5	33	909.9	.001				0.910	753.8	30.0	367.5	
18-54	36	809.5	.001				0.810	674.4	29.2	396.7	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-6, Sector G

SOIL CONDITION _____

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A_1 - A_2) D_1 \cdot D_2 \times 30.5$ $D_1 - D_2$ ohm - cm (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	919.3	.01				9.193	841.2	27.6	27.6	
3-9	6	414.9	.01				4.149	691.9	24.9	52.5	
4.5-13.5	9	258.8	.01				2.588	629.4	23.3	75.8	
6-18	12	185.1	.01				1.851	594.7	22.2	98.0	
7.5-22.5	15	165.5	.01				1.655	1430.1	24.8	122.8	
9-27	18	140.5	.01				1.405	851.1	25.3	148.1	
10.5-31.5	21	115.4	.01				1.154	591.1	24.2	172.3	
12-36	24	91.3	.01				0.913	400.0	21.9	194.2	
13.5-40.5	27	851.0	.001				0.851	1146.6	23.0	217.2	
15-45	30	744.5	.001				0.744	541.4	22.3	239.5	
16.5-49.5	33	679.1	.001				0.679	711.1	22.4	261.9	
18-54	36	633.7	.001				0.634	875.3	22.8	284.8	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-7, Sector G

SOIL CONDITION Dry

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A_1 - A_2) D \cdot \frac{D_1}{D_2} \times 30.5$ $\frac{D_1 - D_2}{D_1 + D_2} \times 100$ (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	917.4	.01				9.174	839.4	27.5	27.5	
3-9	6	351.5	.01				3.515	521.4	21.1	48.6	
4.5-13.5	9	218.4	.01				2.184	527.7	19.7	68.3	
6-18	12	158.9	.01				1.589	533.7	19.1	87.3	
7.5-22.5	15	128.3	.01				1.283	609.6	19.2	106.6	
9-27	18	99.4	.01				0.994	403.8	17.9	124.5	*Questionable Data
10.5-31.5	21	965.5	.001				0.966	3137.8	20.3	144.8	
12-36	24	865.7	.001				0.866	765.4	20.8	165.5	
13.5-40.5	27	786.5	.001				0.786	778.5	21.2	186.8	
15-45	30	721.0	.001				0.721	797.7	21.6	208.4	
16.5-49.5	33	664.8	.001				0.665	783.4	21.9	230.3	
18-54	36	607.5	.001				0.608	549.0	21.9	252.2	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-11, Sector G

SOIL CONDITION _____

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2TVII (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A-A) D \cdot D \times 10^5$ $D_1 - D_2$ ohms - cm (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	128.4	.1				12.84	1174.9	38.5	38.5	
3-9	6	784.6	.01				7.846	1845.8	47.1	85.6	
4.5-13.5	9	418.2	.01				4.182	819.4	37.6	123.2	
6-18	12	273.1	.01				2.731	720.2	32.8	156.0	
7.5-22.5	15	214.6	.01				2.146	916.7	32.2	168.2	
9-27	18	169.7	.01				1.697	742.1	30.5	218.7	
10.5-31.5	21	172.4	.01				1.724*	1919.5**	33.0*	251.7	*Invalid **Assumed
12-36	24	147.9	.01				1.479	2334.8**	35.5	287.2	**Assumed
13.5-40.5	27	132.3	.01				1.323	1147.7	35.7	322.9	
15-45	30	110.0	.01				1.100	597.1	33.0	355.9	
16.5-49.5	33	976.4	.001				0.976	792.2	32.2	388.1	
18-54	36	864.1	.001				0.864	571.0	31.8	419.9	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-8, Sector G

SOIL CONDITION Dry

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2 TV/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $\frac{(A_1 - A_2) D}{D_1 - D_2} \times 30.5$ ohm-cm (E)	(D) x (A) Ohm-feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	113.2	.1				11.32	1035.8	34.0	34.0	
3-9	6	608.7	.01				6.087	1204.8	36.5	70.5	
4.5-13.5	9	417.3	.01				4.173	1214.3	37.6	108.0	
6-18	12	318.8	.01				3.188	1235.8	38.3	146.3	
7.5-22.5	15	223.9	.01				2.239	688.2	33.6	179.9	
9-27	18	174.3	.01				1.743	719.9	31.4	211.3	
10.5-31.5	21	134.7	.01				1.347	542.5	28.3	239.5	
12-36	24	111.5	.01				1.115	592.3	26.8	266.3	
13.5-40.5	27	909.7	.001				0.910	452.9	24.6	290.9	
15-45	30	807.8	.001				0.808	659.6	24.2	315.1	
16.5-49.5	33	794.9	.001				0.795	4521.2	26.2	341.3	
18-54	36	716.2	.001				0.716	659.3	25.8	367.1	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-9, Sector G

SOIL CONDITION _____

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2 TTV/1 (R)	S C A L E	MA (I)	MV (V)	SP (P)	Dial Value Ohms (D)	Barnes Method (A-A) $\frac{D}{d} \times 30.5$ D - D, ohm - cm (E)	(D) x (A) Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	139.4	.1				13.49	1275.5	41.8	41.8	
3-9	6	935.6	.01				9.356	2603.3	56.1	98.0	
4.5-13.5	9	564.4	.01				5.644	1301.6	50.8	148.8	
6-18	12	349.2	.01				3.492	838.0	41.9	190.7	
7.5-22.5	15	258.0	.01				2.580	903.9	38.7	229.4	
9-27	18	185.8	.01				1.858	607.5	33.4	262.8	
10.5-31.5	21	145.2	.01				1.452	608.0	30.5	293.3	
12-36	24	120.4	.01				1.204	645.0	28.9	322.2	
13.5-40.5	27	102.2	.01				1.022	618.6	27.6	349.8	
15-45	30	902.4	.001				0.902	702.9	27.1	376.6	
16.5-49.5	33	795.2	.001				0.902	613.2	26.2	403.1	
18-54	36	709.4	.001				0.709	599.7	25.5	428.6	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT Garland Landfill

UNIT _____

SOUNDING NO. S-10, Sector G

SOIL CONDITION _____

ARRAY _____

DATE October 1, 1987

Electrode Placement	Electrode Spacing Feet (A)	Reading 2T/V/I (R)	SCALE	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $\frac{100 \times A \times D}{D_1 - D_2}$ ohm-cm (E)	(D) x (A) Ohm-feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	130.2	.1				13.02	1191.3	39.1	39.1	
3-9	6	664.3	.01				6.643	1241.0	39.9	79.0	
4.5-13.5	9	725.3	.01				7.253*	1849.8**	45.0**	124.0	*Invalid **Assumed
6-18	12	402.2	.01				4.022	1881.5**	48.3	172.3	**Assumed
7.5-22.5	15	294.6	.01				2.946	1007.6	44.2	216.5	
9-27	18	212	.01				2.12	691.8	30.2	254.7	
10.5-31.5	21	154.3	.01				1.543	518.7	32.4	287.1	
12-36	24	135.4	.01				1.354	1011.4	32.5	319.6	
13.5-40.5	27	113.2	.01				1.132	631.7	30.6	350.2	
15-45	30	927	.001				0.927	468.4	27.8	378.0	
16.5-49.5	33	834.8	.001				0.835	769.8	27.6	405.6	
18-54	36	770.2	.001				0.770	905.1	27.7	433.3	
19.5-58.5	39										
21-63	42										

RESISTIVITY DATA SHEET FOR SOUNDINGS

PROJECT _____

UNIT _____

SOUNDING NO. _____

SOIL CONDITION _____

ARRAY _____

DATE _____

Electrode Placement	Electrode Spacing Feet (A)	Reading 2T/V/I (R)	S C A L E	MA (I)	MV (V)	SP (P)	Dial Value ohms (D)	Barnes Method $(A - A') D_1 D_2 \times 30.5$ $\frac{D_1 - D_2}{D_1 + D_2}$ ohm - cm (E)	$(D) \times (A)$ Ohm - feet (F)	Moore Method (G)	REMARKS
1.5-4.5	3	135.2	.1				13.52	1237.1	40.6	40.6	
3-9	6	650.8	.01				6.508	1148.2	39.0	79.6	
4.5-13.5	9	419.8	.01				4.198	1082.2	37.8	117.4	
6-18	12	308.7	.01				3.087	1067.3	37.0	154.4	
7.5-22.5	15	254.0	.01				2.540	1311.6	38.1	192.5	
9-27	18	204.9	.01				2.049	969.9	36.9	229.4	
10.5-31.5	21	174.4	.01				1.744	1072.0	36.6	266.0	
12-36	24	155.1	.01				1.557	1328.7	37.4	303.4	
13.5-40.5	27	126.1	.01				1.261	606.9	34.0	337.4	
15-45	30	104.6	.01				1.046	561.3	31.4	368.8	
16.5-49.5	33	924.1	.001				0.924	724.9	30.5	399.3	
18-54	36	826.0	.001				0.826	712.6	29.7	429.0	
19.5-58.5	39										
21-63	42										

MAP
55-61